JPRS 79593

4 December 1981

# West Europe Report

## SCIENCE AND TECHNOLOGY

No. 83

FBIS FOREIGN BROADCAST INFORMATION SERVICE

## NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

## PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS 79593

4 December 1981

# WEST EUROPE REPORT

## SCIENCE AND TECHNOLOGY

No. 83

## CONTENTS

ELECTRONICS

AEG-Telefunken Opens Circuit Design Center
(ELECTRONIQUE ACTUALITIES, 16 Oct 81).......................... 1

Thomson-CSF Exhibits Galium Arsenide Circuit
(ELECTRONIQUE ACTUALITIES, 30 Oct 81).......................... 5

Netherlands Research Center for Submicron Chip Technology
(FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT, 13 Oct 81).... 7

Siemens Commercializes High-Speed 64k Dynamic RAM
(F. Grosvalet; ELECTRONIQUE ACTUALITES, 23 Oct 81)............ 8

Briefs
Microelectronics Conference 10
Plasma Etch 10

ENERGY

Method Developed To Increase Efficiency of Solar Cells
(ELEKTRO-ANZEIGER, No 17, 1981)................................ 11

Briefs
FRG-Spain Solar Project 13
New Wind Energy Converter 13
Coal Liquefaction Plant 13

INDUSTRIAL TECHNOLOGY

Study Shows Flexible Workshops Not Economical in FRG
(FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT,
15 Oct 81)....................................................... 14

SCIENCE POLICY

Government Increases Aid, Incentives to Innovation
(Marc Chabreuil; L'USINE NOUVELLE, 22 Oct 81)................. 16

Briefs
Industrial Development Council 18

TRANSPORTATION

Analysis of Competition Between Airbus Industrie, Boeing
(Jacques Morisset; SCIENCES & AVENIR, Oct 81)................. 19

Fiterman Interviewed on Airbus Industry Expansion
(Charles Fiterman Interview; AVIATION MAGAZINE INTERNATIONAL, 15-31 Oct 81)................................................. 27

VFW Performs Ground-Breaking Wind Tunnel Tests for Airbus
(FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT, 13 Oct 81)... 30

BAe Saves Time, Money With New Processes for a 310
(VDI NACHRICHTEN, 25 Sep 81).................................. 32

Briefs
More High-Speed Trains 35

# ELECTRONICS

## AEG-TELEFUNKEN OPENS CIRCUIT DESIGN CENTER

Paris ELECTRONIQUE ACTUALITIES in French 16 Oct 81 p 14

> [Text] Ulm - AEG Telefunken has just made available to outside customers the services of an integrated circuit design center which, until now, had been used only to fill the internal needs of the company and whose importance has considerably increased lately.
>
> The center is original in two ways: it is used to study all types of circuits in all technologies, even those which are not handled by the company's semiconductor plant at Heilbronn. It thus makes use of the properties of P-MOS (aluminum gate), N-MOS (silicon gate), and bipolar circuits (analog, digital, or both in IIL) produced in Heilbronn, as well as C-MOS components from outside vendors. The center offers an unusual range of uncommitted logic arrays including BiFET for low noise applications, transistor networks with a clock time of 5 GHz for A/D conversion, mixers, dividers, etc. and IIL circuits for mixed analog/digital applications.

### Uncommitted Logic Arrays BiFET and 5 GHz

Among the uncommitted logic arrays being designed, the most attractive is certainly a C-MOS network integrating switching capabilities especially designed for filter applications.

The AEG-Telefunken operation in the area of uncommitted logic arrays is very similar to that of its best-equipped competitors throughout the world, in particular, the turnaround times required to personalize circuits may be as short as 2 months. The range of circuits offered by the company at the present time is mostly oriented toward linear applications, or linear and digital combinations. Only two uncommitted ISO-CMOS arrays with 540 gates and 1,000 gates respectively are currently offered for purely digital applications (ref. SP 7005, and SP 7010). Other less complex and more complex CMOS circuits will follow (C 600 and C 1920 with, respectively, 600 and 1,920 gates.)

The first two linear uncommitted logic arrays developed by the company, IMCA [expansion unknown] and BIUS [expansion unknown] are conventional bipolar transistor networks with a 500 MHz clock time for the NPN version and 5 MHz for the PNP version.

The IMCA includes 65 NPN and 14 PNP transistors, 193 resistors, and 5 Zener diodes on an 8 $mm^2$ chip. The BIUS includes 394 NPN and 170 PNP transistors, 594 resistors, 22 capacitors, and 29 Zener diodes on an 18 $mm^2$ chip. The first is well adapted to operational amplifier applications or multivoltage regulators. The second can be used in complex analog applications.

Three other original gate arrays are following: a low-noise model; a UHF module; and, very recently, a module with 2.5 µm structures for high-frequency applications.

The M80/7023 BiFET Array is intended for low noise applications and includes 112 500 MHz NPN transistors, 47 5 MHz PNP transistors, 14 FETs, 261 resistors, 4 capacitors, and 6 Zener diodes on an 8 $mm^2$ chip.

The T 800B UHF array includes 380 5 GHz NPN transistors, 40 5 MHz PNP transistors, 245 resistors, 16 capacitors, 10 Zener diodes, and 12 Schottky diodes. There are 130 output contacts, as compared to 21 to 42 in other modules. This array is well-adapted to A/D converter, UHF mixer, and frequency divider applications.

Finally, the latest transistor array is the BUUS [expansion unknown], a 12 $mm^2$ bipolar array using 2.5 µm structures and including 440 active components (200 of them HF transistors) and 250 passive components. This array is well-suited to HF circuit applications in general, such as preamplifiers, mixers, wideband amplifiers up to 1 GHz, etc.

IIL Uncommitted Arrays with up to 736 Gates

AEG-Telefunken has developed two uncommitted logic arrays for applications requiring a mix of analog and digital circuits, both of them using IIL technology. The first module, BADY 1 [expansion unknown], includes 328 4-output gates, 155 500 MHz NPN transistors, 23 5 MHz PNP transistors, 128 resistors, 2 capacitors, and 58 contacts on a 12 $mm^2$ chip. Like the next one, this circuit uses two metallization layers. The second, BADY 2 [expansion unknown], includes 736 gates, 122 500 MHz NPN transistors, 28 5 MHz PNP transistors, 84 resistors, and 68 contacts on a 16 $mm^2$ chip. These analog components are arranged around the sides of the chip into 28 cells with 4 NPN and 1 PNP 4-collector transistors each. They can be used for logic input as well as control applications. It is thus possible to create output stages with a gain of 10,000 and capable of delivering up to 20 mA.

The BADY 1 may deliver up to 150 mZ, and even 1 Amp, when several cells are connected together.

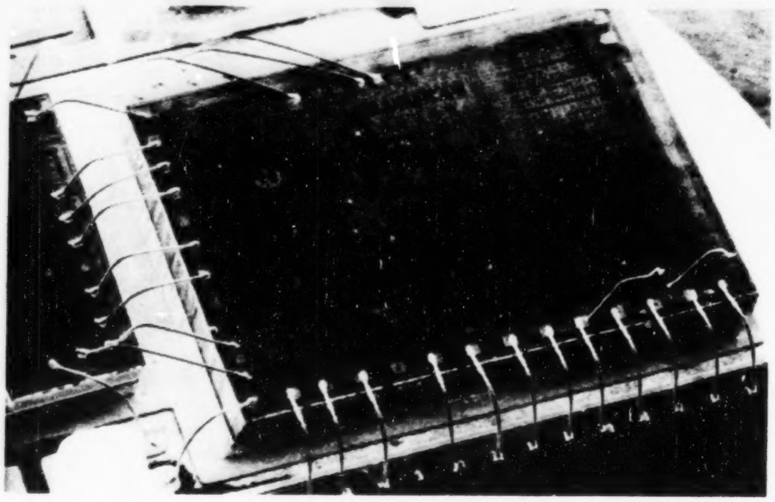
In order for users to be able to build models using the various integrated circuits offered by the company, AEG-Telefunken offers metallized and nonmetallized BIUS circuits to implement simple functions. Sixteen-pin modules with 5 10 mA NPN transistors, 5 100 µA PNP transistors, 3 50 mA NPN transistors, and 2 500 µA PNP transistors are available as well as a 7-input PNP power transistor, a 7-input NPN power transistor, and a modulator (4-cycle multiplier). A programmable quadruple operational amplifier circuit is offered as a 28-pin module. As a 32-pin module, this circuit is quintupled.

A series of standard test circuits also has been developed for the IIL BADY II family: one circuit provides I/O accessibility to 5 NPN and 2 PNP transistors, 1 IIL gate, 6 resistors, and 5 ring oscillators (4 with 7 stages and 1 with 75 stages); another circuit incorporates 2 7-bit phase displacement registers, 1 4x4 multiplexor, and even 3 thyristors; finally, a third circuit includes an I/O accessible 239-gate ring oscillator, 3 resistors, a PNP transistor, and 3 current sources. Circuits with prewired functions also are available in the ISO-CMOS family of uncommitted arrays but we now know that is is possible, through AD design and simulation, to avoid using models for purely logical circuits.

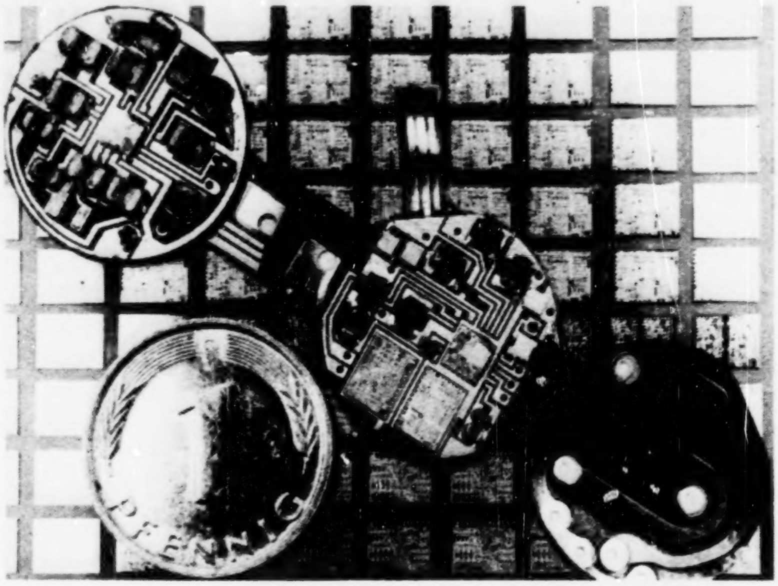
We should point out that, in some cases, AEG-Telefunken makes use in the Ulm plant of their MEBES electronic mask-maker to cut circuits directly on the wafer in order to obtain samples rapidly, without having to cut physical masks. Personalized uncommitted array samples can then be obtained in 2 to 4 weeks. (The company's APPLICON circuit drafting system produces tapes that can be used directly by the mask-maker.)

The wafers are made into uncommitted arrays either at Heilbronn or by outside vendors in Europe or elsewhere.

For the development of uncommitted arrays, the Ulm plant currently has an APPLICON VLSI-860 interactive graphics system with four work stations, a Versatec and Calcomp plotter, a MEBES electronic mask-maker, a Sentry VII automatic tester, and a Hewlett-Packard IEC bus tester, all under the control of a VAX 11/780 computer with 10 terminals.



Set of four custom-made integrated circuits developed at the Ulm design center for a small Doppler effect radar.



The enlarged chip shown is the system's central chip. It uses ILL technology and includes 4,000 transistors for memory, filter, and calculator functions.

6445
CSO: 3102/36

## THOMSON-CSF EXHIBITS GALIUM ARSENIDE CIRCUIT

Paris ELECTRONIQUE ACTUALITES in French 30 Oct 81 p 11

[Text] Fujitsu has just developed the first experimental GaAs integrated circuit (IC) using transistors with high mobility electrons (HEMT, also known as TEGFET--see our issue of 25 September 1981), which makes it possible to approach the speed of Josephson junctions at liquid nitrogen temperature (-169 °C), instead of the latter's operating temperature of -269 °C (17.1 ps propagation delay, compared to 13 ps). This circuit was presented at the Third GaAs IC Conference, held in San Diego (USA) on 27-29 October, where Thomson-CSF described an experimental eight-bit, fully decoded static RAM, also made of GaAs, which uses the LPFL technology (see our issue of 5 December 1980) developed by the LCR [expansion unknown], and which has an access time of 0.6 ns and consumes 80 mW.

The devices presented by both companies are only the first in the field of rapid logic GaAs IC's. By using finer geometries, Fujitsu hopes to obtain--still at liquid nitrogen temperature--propagation times of 10 ps for 10 uW consumptions. This should open the way for very rapid VLSI circuits which could eventually replace Josephson components. For its part, the LCR is developing a 256-bit RAM with an access time of 1.5 ns, in order to obtain by the end of 1983 a 1K device accessible in less than 2 ns. The technologies used by the French and the Japanese may seem to compete against each other. Indeed, with a technology similar to the one used by the LCR (called quasi normally-off because the transistors are nearly off at rest), NTT has obtained GaAs FET'S with switching times of 30 ps at ambient temperature, and 17.5 ps at 77 °K. The drawback of this technology however, is the consumption and the difficult fabrication (it requires 0.5 micron grids).

## 17.1 ps And 0.96 mW Per Stage at 77 °K

Using HEMT transistors with 1.7 micron-long grids, Fujitsu has built a 27-stage ring oscillator with propagation times of 17.1 ps/stage, and with a consumption of 0.96 mW at 1V and 77 °K (giving a figure of merit of only 16.4 fJ). With grid lengths of 1 micron, Fujitsu hopes to obtain three times the mobility at liquid nitrogen temperature (60,000 $cm^2$/V), which should make it possible to reach propagation delays of 10 ps and consumptions lower than 100 uW. The circuit of the Japanese company was built on a semi-insulating GaAs substrate by molecular jet epitaxy. The Thomson CSF LCR also uses vapor phase epitaxy. The eight-bit (4xtwo-bits) memory presented in San Diego integrates 170 components, of which 77 are quasi normally-off MESFET's with 0.8 micron grids and threshold voltages between -0.2 V and 0.2 V. It operates at 4.6 V. Each memory cell includes two transistors, four resistors, and two Schottky diodes, and covers an area of 5900 $micron^2$ (0.5 $mm^2$ for the entire memory). The consumption is 1.6 mW per memory point, and the LCR hopes to obtain 0.45 mW for the 1K RAM by using a finer geometry.

11,023
CSO: 3102/44

ELECTRONICS

## NETHERLANDS RESEARCH CENTER FOR SUBMICRON CHIP TECHNOLOGY

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 13 Oct 81 p 5

[Text] The Advanced Technical School in Delft, Holland, will establish a national center for submicron technology (submicron = smaller than a thousandth of a millimeter). The minister of science policy in The Hague, van Trier, indicated shortly before the change in the cabinet in the Netherlands some weeks ago that he is prepared to make available to the institute financial means in an as yet undisclosed amount. As the minister wrote the administration of the Delft Advanced Technical School, other institutes, including N. V. Philips, are also interested in the establishment of a submicron center in Delft, and it would be possible to expect financial support from them, too.

According to one of the initiators of the center, Prof Dr B. le Poole, lecturer in electron optics in the Department of Technical Natural Science at the Delft Advanced Technical School, the intention was to establish a center like the American National Submicron Facility at Cornell University. The center will be concerned not only with the use of superchips and with semiconductor technology. It will make possible research from all angles which could play a role in the production of submicron sturctures, also for researchers from other universities or from industry. Everything that is needed to produce submicron structures and everything that is necessary for experiemnts on a submicron scale will be provided. In general, the center will serve to collect experiences and findings in the field of submicron technology. The center will also have to be involved with the problems of industry, and perform research tasks for them if necessary. Professor le Poole said in closing that, although people in Leuven (Belgium) and Aachen are also working in the field of submicron technology, the center in Delft will be unique in Europe because it will be concerned with more than the application of technology.

12124
CSO: 3102/24

ELECTRONICS

## SIEMENS COMMERCIALIZES HIGH-SPEED 64K DYNAMIC RAM

Paris ELECTRONIQUE ACTUALITES in French 23 Oct 81 p 15

[Article by F. Grosvalet]

[Text] Siemens is commercializing a memory with a 150 ns access time and a power consumption of 120 mW.

Siemens has begun to spot-market in France its 64K dynamic RAM (DRAM), the HYB 4164, which it announced more than two years ago. Volume production should start before the end of the year in a new plant that the company has built in Austria at Villach (as well as in Munich); it will reach 100,000 units per month in 1982. Siemens thus becomes the first European company to manufacture a 64K DRAM; the British company Inmos had also announced such a device last April, but its product has still not been introduced.

The price of the HYB 4164 has not yet been established, but all other things being equal, the slowest version should be sold for less than $10 in large quantities, starting early next year, which would place it squarely in the middle of the price range (the average price of 64K DRAM's should reach $3 in 1986).

### Late Arrival

Even though other manufacturers give Siemens few chances of success, a large market study company, Gnostic, believes that despite its late arrival, the German company will play an important role because it has a good technology (notably for protection against alpha particles) and a good product, equivalent to that of the Japanese. However, Gnostic expresses some reservations about Siemens' ability to follow through in production.

### 150 ns Access Time

As all 64K DRAM's, the HYB 4164 is organized in 64K one-bit words and operates at 5V; but it has a 150 ns access time and typically consumes only 120 mW (150 mW maximum) during operation, and 12-15 mW at rest (20 mW maximum). A less rapid version is also available with an access time of 200 ns, and a typical consumption of only 100 mW during operation (150 mW maximum).

The fact that this memory has an access time of only 150 ns is very important for the success of its market introduction, since memories with this specification, which are in the greatest demand, are still quite rare.

Siemens has succeeded in reducing the access time and consumption of its memory by using half as many read amplifiers and a 256 cycle refresher. Except for these characteristics, the HYB 4164 is rather conventional, both in structure and operation. It is built as a silicon grid NMOS, with an area of 29.5 square millimeters, and uses no redundancy. It is offered in a 16-lead ceramic DIP package.

Another original aspect of this memory is the manner in which it is protected against alpha radiation. To this end, the German company uses a photoreactive organic polyamide film which is very easy to apply (it requires fewer processing steps than conventional films).

## 2.1 Billion Dollars in 1986

With the HYB 4164, Siemens is entering a market which promises to be the most profitable in the history of semiconductors (it should top at $2.1 billion in 1986), just at the time when it is beginning to take off. According to Dataquest for instance, eight million 64K DRAM's have been sold in 1981, compared to 400,000 in 1980 (11 million according to ICE).

Siemens, who believes that in 1985 only 5-10 manufacturers will be capable of supplying the 64K DRAM market (estimated at 650 million units by Dataquest), hopes to be one of them and to eventually capture 5 percent of the world market. Today, this market is dominated by the Japanese (according to ICE and Dataquest, they control 70 percent of it): out of eight mass production manufacturers, six are Japanese (led by Hitachi and Fujitsu, followed by Mitsubishi, OKI, Toshiba, and NEC), and two are American (Motorola, closely followed by Texas Instruments). This situation could very well change in 1982 with the arrival of Siemens, Intel, National Semiconductors, Inmos, and Fairchild, and the introduction of more rapid models (which are in the greatest demand). Currently, few manufacturers are able to supply models with access times lower than or equal to 150 ns, and some, like Intel and Motorola, have been forced to either redesign their circuits, or develop a second generation.

Most of the American manufacturers feel that they still have time to react, and that the arrival of new American companies on this market will gnaw away at the Japanese domination. According to Texas Instruments for instance, the United States should have 60 percent of the world market in 1984.

In Europe, ITT should be the next to attempt a 64K DRAM, since Eurotechnique's device as second source to National Semiconductors is forecast only for the end of 1982.

11,023
CSO: 3102/43

## BRIEFS

MICROELECTRONICS CONFERENCE--The French Vacuum Society has scheduled a Workshop on Plasma Etch in Microelectronics, to be held on 24, 25, and 26 November, in Grenoble, at the Centre d'Etudes Nucleaires. This workshop, at which will be presented the various studies being conducted in France in reactive plasma, reactive ion plasma, and reactive ion beam plasma, is sponsored by DGRST (General Delegation for Scientific and Technical Research), DAII (International Industrial Affairs Directorate), DIELI (Bureau of Electronics and Data Processing Industries), and by the Ministry of Industry. New ion etch equipment manufactured by ALCATEL in collaboration with LETI-CENG will be shown at the end of the workshop. For information: SFV, 19 rue du Renard, 75004 Paris, Tel. (1) 278.15.82. [Text] [Paris ELECTRONIQUE ACTUALITES in French 23 Oct 81 p 13] 11,023

PLASMA ETCH--A new company which will manufacture plasma etch equipment, Plasma Technology, has just been formed. This British company sells a planar plasma etch system, the PE 80. The PE 80 is a compact, inexpensive system, designed for small productions and for research and development laboratories, which will be in a position to evaluate the advantages of this type of plasma etching. [Text] [Paris ELECTRONIQUE ACTUALITES in French 23 Oct 81 p 13] 11,023

CSO: 3102/44

## METHOD DEVELOPED TO INCREASE EFFICIENCY OF SOLAR CELLS

Essen ELEKTRO-ANZEIGER in German No 17, 1981 p 10

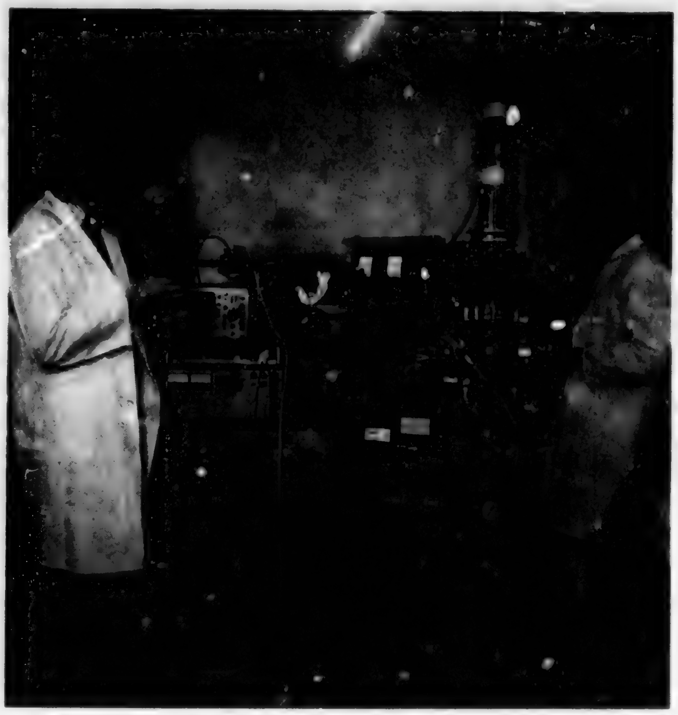
[Text] At the Karlsruhe Nuclear Research Center (KfK), an electron beam generator has been developed for the short-time heat treatment of the surface of solar cells. This so-called short-time annealing is of great importance for the cells' efficiency in converting sunlight into electrical energy. In addition, the new electron beam generator promises particularly economical completion of this basic step in the mass production of solar cells.

Solar cells, which are spoken of today as mass-produced articles, usually consist of single crystals of the semiconductor silicon, in which foreign atoms are embedded in very low and precisely controlled concentrations. Light falling on them releases in the silicon negatively charged electrons and positive charges, so-called "holes," which are separated by the electrical action of the embedded foreign atoms and create a usable electrical current. A familiar application of this principle is the light meter in a camera.

For reasons of physics, these semiconductor elements have a maximum efficiency; that is, the ratio of usable electrical energy to the light energy falling on them is about 20 percent. In practice, the degrees of efficiency achieved today are about 10 percent, and they are largely dependent on the purity--that is, the unblemished formation--of the crystal lattice on the light-sensitive surface layer. A requirement for good purity is thermal treatment--annealing--of the surface, which cures the faults in the crystal caused by the implantation of the foreign atoms, but which does not cause a redistribution of the foreign atoms by diffusion. For reasons of physics, only short-time annealing can be used. A process of this kind is also a requirement for the inexpensive mass production of solar cells, since it makes continuous treatment of large areas possible with low energy use. Extremely short-time electron beam impulses of a particular energy density and with relatively large spatial expansion, which penetrate only a short way into the semi-conductor layers, can do this, but until now it has not been possible to produce them.

An electron beam generator with the required characteristics was developed for this purpose at the KfK's Institute for Applied Nuclear Physics (IAK). The electron beam has variable energy from 10 to 25 keV, which is the equivalent of the required penetration depth of up to $10^{-3}$ mm; pulse duration is about 0.3 $\mu$sec, current densities in the beam are 1,000 to 3,000 A/cm$^2$ and the pulse energy deposited in the material is adjustable between 0.3 and 2.5 J/cm$^2$. The diameter of the electron beam is about 5 cm at the point of irradiation. In the field of electron beam technology these operational data are unique so far.

Development work at the IAK lasted for about 2 years and cost about DM 80,000. Laboratory testing of the equipment has been successfully completed. It is currently being used by interested parties for the test manufacture of solar cells. Further development is aimed at industrial application.



The laboratory equipment for the short-time annealing of solar cells on a silicon base consists of an electron beam generator, upper center, the vacuum chamber for the irradiation of the silicon slices, center, and the vacuum apparatus in the lower part of the picture. On the left the essential electronic controls can be seen. The picture shows the silicon slices being inserted for short-time annealing. (Picture courtesy of the Center for Nuclear Research, Karlsruhe)

9581
CSO: 3102/29

## BRIEFS

FRG-SPAIN SOLAR PROJECT--An agreement has just been signed in Madrid between the FRG and Spain for joint research into the conversion of solar energy into electricity using gas-cooled "solar towers." The project, named "Guest," calls for investments in the amount of about DM 88.4 million in the Almeira Solar Energy Research Center (southern Spain) and later the construction of a 20-MW solar power station in the western Spanish province of Badajoz. [Text] [Wuerzburg ELEKTROTECHNIK in German 11 Sep 81 p 7] 9581

NEW WIND ENERGY CONVERTER--Voith Getriebe KG [limited partnership] of Heidenheim recently began test operations with the wind energy converter which it developed and whose erection has just been completed near Stoetten in the Swabian Alb. The 300-kW generator is located at the foot of the 30-meter high mast, which carries at its top the pod with the two 26-meter-long rotor blades, the transmission and the control machinery. A tubular shaft connects the pod with the generator. At medium wind speeds of 8.5 m/sec, rotor output is designed to be 316 kW. The 380 V direct current is fed into the 20-kV cross-country grid through a transformer. The project has been subsidized since 1976 by the FRG Ministry for Research and Technology. [Text] [Wuerzburg ELEKTROTECHNIK in German 11 Sep 81 p 7] 9581

COAL LIQUEFACTION PLANT--Geisenberg AG, a subsidiary of Deutsche BP AG and Saarbergwerke AG have announced a joint project to build a coal liquefaction plant with a capacity of producing 1 million tons of gasoline in the Saar region. With an anticipated cost of 3 billion DM, the plant will only be built (starting in 1984) if the results obtained at a pilot installation turn out to be satisfactory. The process will be a modernized version of the process developed by IG Farben during World War II. The new plant could be operational between 1988 and 1990 and would be capable of processing 2.3 million tons of coal per year. The coal would be produced by Saarbergwerke Company. [Text] [Paris CHIMIE ACTUALITES in French 25 Sep 81 p 10] 6445

CSO: 3102/36

## INDUSTRIAL TECHNOLOGY

### STUDY SHOWS FLEXIBLE WORKSHOPS NOT ECONOMICAL IN FRG

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 15 Oct 81 p 7

[Text] Frankfurt, 14 Oct--As a response to the growing demand for automation in small and medium production runs in the metal processing industry, [word omitted in text] were developed, beginning in the mid-1960s, in which individual numerically controlled machine tools were linked by material flow and information systems. According to initial prognoses, these systems were supposed to spread rapidly in the FRG. Because of the associated high degree of automation and large capital investment (the acquisition costs for a system are mostly between DM 3 and 20 million), substantial effects on the competitiveness, company structure and the organization of work in the metal processing industry were anticipated.

As the Frauenhofer Institute for Systems Technology and Innovation Research in Karlsruhe has just shown in a study, these ambitious expectations regarding the spread of flexible manufacturing systems have not been fulfilled. There are only 10 to 15 such systems in the FRG in 1981. The numbers of systems in use in Japan and the United States are much higher, although the flexibility of the systems installed there is clearly lower than in the FRG (in the United States, most flexible manufacturing systems are designed to handle 5 to 10 different pieces, in Japan 10 to 100, but in the FRG from 100 to 200).

In all the Western industrial countries, flexible manufacturing systems have been installed predominantly in large plants, mainly in the machine, construction vehicle construction and aerospace industries. Besides the high purchase price, the reason can be found in the considerable expenditure of time and money required for the planning and introduction of these systems: According to the findings of the Frauenhofer Institute, equivalent costs in the FRG average DM 1.9 million, and the time required is between 3 and 6 years. These figures are considerably lower in Japan and the United States. It is predicted that the costs of planning and introduction will also fall in the FRG: For newer systems, the expenditure for introduction has already dropped to an average of DM 1 million.

The hesitant introduction of flexible manufacturing systems in the FRG is determined principally by the high purchase costs. The flexible systems used here are also not yet economical in most cases. This is not true for the American systems, which are less advanced but operate more economically. It is expected that the growing demands for automation and flexibility will boost the use of flexible manufacturing systems in the FRG as well. Increasingly, the path of gradual development will be followed with respect to automation, flexibility and system size. At the same time, both acquisition costs for the various system components and the cost of planning and introduction must be reduced. It is also necessary for manufacturers to commit themselves more heavily to the intorduction of flexible manufacturing systems (in the area of design and consultation). The state should support the manufacturers in this offer of services and, in the opinion of the institute, subsidize introduction principally in smaller and medium-size companies.

9581
CSO: 3102/31

# GOVERNMENT INCREASES AID, INCENTIVES TO INNOVATION

Paris L'USINE NOUVELLE in French 22 Oct 81 p 85

[Article by Marc Chabreuil: "Innovation: Releasing the Last Brakes"]

[Text] "To gain 10,000 research enterprises over the next 5 years," is the ambitious goal which Anvar [National Agency for the Valorisation of Research] has established for itself. Following the national meeting which the agency organized in Lyon, this challenge seems possible to meet. For, its field of activity is going to expand and diversify itself. Furthermore, the agency benefits from the strong support of the minister who oversees it, Jean-Pierre Chevenement, and of the prime minister, both of whom came to back this event.

In addition to the good report he issued to Christian Marbach, president of the agency, Pierre Mauroy used this occasion to try to win over the 800 heads of enterprises who were present. And, through them, the small and medium-size industries on the whole. For there are many who are showing their gloom and admitting that their innovative projects are shelved for the present.

## At the Heart of the Discussions: Financial Matters

After having assured them that "the enterprise will remain an autonomous center of decision," the prime minister attacked the current banking system. According to him, "it is poorly adapted to the needs of enterprises and grants too large a place to supplier credits and short term lending." A problem which closely affects manufacturers, accustomed to the hesitation of bankers when long term projects or establishment of businesses are involved.

Financial questions, for that matter, were at the heart of this national meeting. And Jean-Pierre Chevenement made more statements on this subject, announcing measures which will come in both up and down the line from innovation, in Anvar's sense of the term (research and development of a prototype).

It is thus that, starting in 1982, the agency will implement mechanisms to take on part of the purchase price of new products in order to lower their prices and encourage their sales. Similarly, it will participate in "intangible" investments (research and development, purchasing of patents and licenses, market studies).

These are important decisions for small and medium-sized industries, but do not include a measure for financially assisting the industrialization of an innovation, a measure clamored for by the small enterprises who often do not have the appropriate capital required.

Through Inodev [expansion unknown] they will finally have access to medium term loans, as the government has decided to activate this organization by increasing the number and the size of the loans available and reducing the interest rates. To do this, it is counting on joining with other partners (Anvar, banks,...). Simultaneously, negotiations are in progress between Jean-Pierre Chevenement and Jacques Delors to adapt the banking system to this phase of innovation.

Also at the request of Anvar, which is Jean-Pierre Chevenement's main "bridge" to the industrial sector, three new companies for financing innovations are going to be created: Finovelec (rational use of energy, electricity and electronics), Electrinova (same areas, but basically for small and medium-sized industries) and Idianova (aquicultural and food/agricultural products). "Recourse to such companies for moderate raising of capital or contribution of appropriate funds in the form of convertible loans will spare the manufacturers the risks associated with the embroilment of a new partner in their capital," affirms Jean-Pierre Chevenement who, in this case, is counting on the participation of nationalized companies.

These companies, moreover, will be more and more involved with innovation, whether by doing contract research for the small and medium-size industries, or by assisting their personnel to create high technology companies. Christian Marbach, who already has limited contracts with Elf and Renault mentions "the creation of joint teams with these industrial groups and the placing of an Anvar representative within each of them."

Other projects are under study or in discussion with the ministers involved: increasing the rate and the conditions for allocation of premiums for innovation, partial assumption by the agency of the documentation for establishing companies, broader support for industrial research through assuming some of the personnel expenses (on the condition that actual results be obtained in less than 2 years), making assistance to innovation more widespread in technical colleges to make students and professors, in particular, more open to creativity.

All additional expenses with a strong risk of causing the budget to be exceeded. Now, Jacques Delors and Laurent Fabius, already hostile to the large increase in funding granted to research, refuse in principle to accept any idea of a collective. "We have planned for next year the maximum of what we can do in research and development," states Pierre Mauroy, who seems to be delaying any possible measures on fiscal incentives to innovation for at least 2 years.

Without going so far into the future, can the government, and through it Anvar, finance all the measures announced...in the future or conditionally?

9693
CSO: 3102/39

## BRIEFS

INDUSTRIAL DEVELOPMENT COUNCIL--A Higher Council for Industrial Development will be formed next year, according to the announcement made by Prime Minister Pierre Mauroy during his presentation of the nationalization law to the Chamber of Deputies. This council, he said, will "gather together all concerned parties," and will have the objective of "creating a consensus on the goals and means of our industrial development." He went on to add that it will "participate in a fresh new growth, encourage the creation of jobs, particularly in small enterprises, develop exports, and recover a domestic market,...as well as assure for France the mastery of technologies that are most decisive for the future." [Text] [Paris ELECTRONIQUE ACTUALITES in French 23 Oct 81 p 2] 11,023

CSO: 3102/43

TRANSPORTATION

## ANALYSIS OF COMPETITION BETWEEN AIRBUS INDUSTRIE, BOEING

Paris SCIENCES & AVENIR in French Oct 81 pp 98,99,101,102,104

[Article by Jacques Morisset: "The 767 Against Airbus: Boeing's Response"]

[Text] What the American builder is offering is not simply an anti-Airbus plane but a complete line of planes ranging from 190- to 300-passenger versions, to prevent the European plane from capturing one-third of the world market by the year 2000.

As these lines are being written, the prototype of the B 767 is being prepared for its first flight over the Everett airdrome near Seattle. The new, red-white-and-blue-colored plane was rolled out of its hangar on 4 August, 3 and 1/2 years after the launching of the B 767 program--a major event at Boeing, who had not produced a single new plane since 1968, the year in which this same Everett plant rolled out the first B 747, the "Jumbo Jet" as it is universally known now.

In 11 years, however, the physiognomy of air transportation has changed radically. The incredible rise in the cost of fuel has been and continues being the number one factor in this change; the golden age of air transportation (+10 percent yearly) dates back to the time when the price of the well-known barrel was just a few dollars, barely higher than the cost of its extraction, transport and refining. It has now reached $36, the difference being for the most part being siphoned off by the black gold producer countries; and the experts are unhesitatingly forecasting that by the middle of the coming year the producers' selling price will exceed $50 a barrel.

Twelve years ago, the cost of fuel was thus considered relatively negligible; today, it represents 20-30 percent percent of the per-hour cost of flying. And, it would seem, the worst is probably still ahead of us...

The consequences are known: The Concorde, too great a fuel guzzler, is moribund, without having effected the market penetration its promoters had hoped for. The first-generation jet planes are now doomed: Their engines consume too much fuel. And the airlines, despite a precarious financial situation, are now demanding planes powered by ultra-economic engines.

The all-purpose plane, usable for flights whose range might vary by a ratio of as much as 1 to 10, hence not highly optimized, has given way to planes "fine-tuned" to a specific purpose and lightened to the maximum, offering a 30- to 40-percent reduction in passenger-kilometer consumption. Of course, the modern turbofan is the principan artisan of this reduction in fuel consumption, with the advances made in aerodynamics and new materials accounting for the rest. But the fact remains no less true that a long-range plane designed to carry a heavy fuel load is needlessly heavy for short- and medium-range flights, under which conditions its efficiency is mediocre and a plane optimized for this type of service appears indispensable.

True, the engineers had long since seen the need for this specificity: Dassault's Mercure (which appeared too early and was poorly backed, thus explaining its failure) in fact heralded this evolution. But the airlines balked at abandoning their planes, which in many cases were not yet amortized: A change of equipment (and of supplier) is in fact costly and is financially dangerous if the equipment in question has not been completely tested and perfected before being put into service.

Boeing, as the leading supplier, could hardly do other than perpetuate a situation from which it itself was reaping the greatest advantage. Its B 747 (long-range), B 727 (medium- and short-range) and B 737 (short-range) planes were continuing to sell and to generate all the more profits since their design and tooling costs had been largely amortized or no longer on the books.

### The 300-Passenger Niche

In this relatively full gamut, however, there is a fault, and a major one: The B 737 is a 100- to 120-passenger twin-jet; the B 727 is a 130- to 160-passenger 3-jet plane; and the B 747 is a 4-jet plane that can accommodate up to 500 passengers. What was lacking, therefore, was a 300-passenger plane. Lockheed, however, with its 3-jet L-1011 Tri-Star, and Douglas with its DC-10, also a 3-jet plane, largely occupied this niche.

It was then that the Europeans, led by France, decided finally to take up the gauntlet, and created the Airbus Industrie consortium, the main objective of which was to create a twin-jet 250/300-passenger short- and medium-range plane, baptized the A 300. The proposed plane was to:

--offer a lower passenger-kilometer operating cost than that of the 3-jet DC-10 and Tri-Star, simply because it would be markedly lighter and a twin-jet, and optimized for flights of from 500 to 2,500 kilometers.

--make available to airlines that were already using B 727's a dual-capacity plane, without their having to resort to buying planes as heavy and costly as the Tri-Star and the DC-10, or, a fortiori, the B 747.

The A 300 quickly proved to be an excellent plane; but success was a long time in coming, as airlines other than those of the promoting countries saw no reason to take a chance on changing suppliers: Actually, a transport plane is bought for 15 or 20 years to come; and, aside from the fact of its French and German backing, there was nothing to prove that 15 or 20 years down the road Airbus Industrie would still be an active supplier, capable, for example, of providing a high-quality post-sale grade of service, and of developing improved versions, taking advantage of the technological advances made with time.

It took OPEC and the second wave of oil price rises to bring the potential users--impressed though they were by the good results obtained with the first Airbuses put into service--to the point of finally deciding to "take the risk." What followed was a veritable tidal wave of orders; and Boeing (who found it hard to believe), Lockheed and Douglas suddenly found themselves confronted by an unexpected situation: The advent of a serious competitor, occupying a niche they had mistakenly considered too narrow. True, the DC-10-10 and the L-1011-1 and -100 "medium-range" versions were already in existence; but the decision taken by the Eastern Airlines company (headed by former astronaut Frank Borman) to buy several dozen A 300's exploded like a bombshell, and the European Airbus became a serious competitor.

It took the announcement of a new improved and slightly shortened version, however--the A 310--for Boeing, perceiving at last that the situation had become serious, to decide to enter the arena again. After months of talks with the major American airlines, and just a few days after disclosure of the first orders for the European A 310's, it announced the coming of the B 767. It was certainly not by mere chance that these two disclosures occurred at the same time; and, for the first time in a long time, Boeing found itself compelled to attack defensively.

Things might well have remained as they were; after all, the B 727 still had some halcyon days to look forward to, and so did the B 737; only Douglas had made an effort to recapture the market with an improved version of its DC-9 (the Caravelle's killer), the DC-9 Super 80. But Boeing had established such a lead in terms of number of planes sold and of client airlines (around 250, versus 150 for Douglas), who were still inclined toward completing their fleet with planes of the same kind, that the Super 80 represented no great danger, all things considered. And the speedy, but costly, launching of the B 767 (200 seats, like the A 310), seemed likely to keep Boeing sufficiently occupied.

## Occupying the Terrain

But this was tantamount to underestimating the Seattle builder, whose eyes were now opened; the more so, in that the Europeans appeared to be taking the bit in their teeth: Fokker, which was laboring to sell its F-28 (80 seats) seemed determined to promote an F-29 (100/110 seats); AEROSPATIALE [National Industrial Aerospace Company] was pressing its Airbus Industrie partners for agreement on the (AS 200) project for a 130- to 160-passenger plane as a potential competitor of both the B 737 and the B 727. And Airbus Industrie was from time to time leaking information on two new projects: the TA 9 (a lengthened A 300, capable of carrying more than 300 passengers) and the TA 11, a 200-passenger, 4-jet, long- and very-long-range airliner; in short, by adding to its weight but carrying more fuel, the basic A 300 was shown to be capable of exceeding a range of 5,000 kilometers. A long-term strategy began to take shape in Europe, therefore, aimed at offering a more and more extensive line of products. And for Boeing, the danger loomed larger of its having to fight on all fronts against a competitor that was all the more aggressive because of the tentative backing being provided to Airbus Industrie by the German, British and French governments, while Boeing, or at least its "civilian" subsidiary (Boeing Commercial Airplane Company), has no governmental support and can only count on its own resources, its clientele and the banks.

The tactic adopted by it in response to this threat is a simple one: Occupy the terrain both as regards the airlines and the aviation industrialists not associated with Airbus Industrie. And over the past 3 years, Boeing's response has been one of sheer power, wherein, flanking the B 767, the anti-Airbus par excellence, it has launched successively:

--The B 757: A 160/180-passenger twin-jet, something of a cross between the B 727 (diameter of the fuselage) and the B 767 (technology of the control surfaces, the electronic and hydraulic systems). The first B 757 will fly within a few months and will be put into service by the beginning of 1983;

--The B 737-300: A lengthened B 737 (it will accommodate 140 seats), modernized and powered by new engines: the General Electric/SNECMA [National Corporation for Aircraft Engine Design and Construction] CFM 56. It will be available by the end of 1984;

--Tentative plans (but with a good chance of being actualized) for a B 727-200 RE (for "re-engined"). This would not be a new model or a new version, but a modernization of existing B 727-200's, modifying the entire rear end: The three (old-type) existing engines will be replaced by two modern engines, the horizontal tail unit will be enlarged, and the equipment will be upgraded to state of the art, particularly insofar as concerns the cockpit. Cost of the operation: Less than half that of a new plane. Advantages for the client: A less noisy and substantially more economical plane to operate, since it will consume around 25 percent less fuel. The number of planes that can be thus re-engined and modernized: Around 800, out of the approximately 1,800 B 727's of all types sold to date. Many American airlines are showing a great deal of interest in the B 727-200 RE;

--Tentative plans also for a B 7-7 (B 787?), a 150-seat twin-jet--a relatively new plane in this case.

This clever tactic, consisting of a well spaced out series of roll-outs over a number of years, gives Boeing the advantage of occupying the terrain and dissuading its customary clients from looking around for other possibilities; but it poses problems of scale: The B 727-200 RE threatens to slow the sales of its B 737, those of its B 757 (this plane being situated at exactly a halfway point in its timetable), and those of its future B 7-7. Moreover, in terms of work volume, the conversion of the B 727 to the B 727 RE is much less interesting than the building of new planes; in fact, those most interested in it are the engine manufacturers... .

However, although Boeing is thus attacking on all fronts, having furthermore announced long-range versions of the B 767, and improved versions (lengthened upper deck) of the B 747, it finds itself somewhat constrained as to modernizing the lower end of its line, for in all cases Boeing wants to maintain the same diameter of fuselage--in fact, that of the old B 707.

## Boeing in a Defensive Position

Boeing's competitors, on the other hand, entirely free to choose, as they are, feel no constraints on highlighting the merits of the wider body and the greater passenger comfort it offers. Since the beginning of this year, plans have been announced for three 150 (actually, 130-180)-passenger, short- and medium-range planes:

--Airbus Industrie's A 320 (ex-AS 200). At the Bourget Exposition, the European consortium announced its decision to proceed; Air France, for its part, disclosed its intention to purchase some 50 of these planes. Scheduled for delivery by 1986, the A 320 will be available in two versions: The A 320-100, which can carry 154 passengers in single-class accommodations over a distance of 3,500 km, and the A 320-200, which can carry 172 passengers over the same distance. By comparison with the B727-200, which is considered the pacemaker plane to be replaced, the A 320 will offer a 20-25 percent lower operating cost, thanks to a 40-percent lower fuel consumption rate. From the standpoint of comfort, its internal width will be greater by 15 centimeters: Passengers will therefore feel less constrained;

--The B 7-7, less new than the A 320, since it is more or less derived from the B 757, but, because of this, less costly to develop and offering a commonality with the latter that can be of interest to users. Its disadvantage: The diameter of the fuselage remains unchanged. In any case, Boeing, financially constrained, as we have pointed out, by the already-launched B 737-300 and B 757 programs, does not expect to have its B 7-7 on the market before 1987 or 1988. The Seattle builder thus finds itself well and truly, for the first time, in a defensive position and compelled, in a manner to which it is unaccustomed, to follow the lead of the Europeans;

--The MDF-100, fruit of a joint study (currently under way) between Fokker and McDonnell Douglas. The former brings to the joint effort the F-29 project (completely revised); the latter, its own studies on a DC-11 undertaken--Oh, irony!--with Dassault, based on the Mercure (a Franco-American project, later abandoned, to bring out a Super Mercure). But the characteristics of the MDF-100, still in the evolutive stage, have not yet been laid down; nor has the date of its launching. In fact, Fokker favors a narrow fuselage, and Douglas a very wide one. The airlines, having been consulted, will settle for something in between.

Three major factors now condition the effective launching of these programs: The coming off the production line of the announced new ultra-economical engines, the availability of funds, and based on the latter, the possibilities of cooperation. On the first point, three engine builders have thrown their hats into the ring for the needed 11- to 12-ton thrust engine: General Electric and SNECMA with a CFM 56-2000; Pratt and Whitney with a possible PW 2025; Rolls-Royce and its Japanese associates with the future RJ-500. But to develop a new engine costs some $2 billion (around Fr 12 billion). This consideration alone explains the fact that, according to the latest information, Pratt and Whitney and Rolls-Royce are contemplating a cooperative effort. This would leave no more than two engines from which to choose; that is enough, say the experts.

On the second point(here again, the cost of developing a new plane is around $2 billion), Airbus Industrie appears to have the advantage, provided, however, that the three governments play their part in the game and that the builders, for their part, can come up with a minimum of financing of their own. Boeing will not be able to find the necessary financing unless the marketing of the B 767, the B 757, and the B 737-300 brings in substantial profits. This is evidently not a likely prospect within the present context, the controller strike in the United States having precipitated a deterioration of operating conditions for the airlines and led some of them to bite the dust. Even Pan Am is in difficulties, compelling it to sell its hotel assets. Hence, no more orders, for the moment.

On the third point, Boeing has, during the past several years, pursued a shrewd policy aimed at attracting the technical and financial collaboration of certain non-American industrialists, so as to not only enable it to reduce its own investments but also to pull the rug out from under Airbus Industrie just in case the latter might be tempted by the worldwide opportunity that would otherwise exist. This operation has fully succeeded with Italian industry, has all but succeeded with British industry (however, the United Kingdom has finally toppled, at least partially, into the lap of Airbus Industrie), and is proceeding toward success with Japanese Industry. True, the Japanese industrialists are currently holding talks with McDonnell Douglas and Fokker as well, but on a level that has remained purely hypothetical.

This type of cooperation, however, remains limited: Boeing has retained full leadership, its industrial associates being fully satisfied with being assured of long and even very long production runs (we may some day see the roll-out of the 2000th B 727...). Airbus Industrie, on the contrary, is developing a much more integrated type of cooperation among the three leading countries--France, Germany and Great Britain--without overlooking Spain, the Netherlands and Belgium. Decisions take longer, but they are vested with a spirit of cooperation among equals that is in strong contrast with the sovereignty exercised by Boeing.

Although the future of the 150-passenger plane is assured, though still somewhat hazy (Will there actually be three programs, or more probably two?), the current struggle has thus become circumscribed between the European Airbus on the one hand and the Boeing B 767 on the other. The fact is that Lockheed and Douglas are merely idling, except insofar as concerns the DC-9 Super 80, which could well mean their disappearance within a short time as major builders of civil aircraft and their transformation into subcontractors of Boeing and Airbus Industrie.

## One-Third of World Market for Airbus

At Airbus Industrie, the situation is as follows: Orders for the A 300 and A 300-600 (an A 310-type modernized A 300) total 316 planes (239 firm orders and 77 options). The 150th A 300, which is to be delivered to Eastern Airlines, will be delivered within the next few days. The production rate now exceeds four planes a month, will increase to five a month next year, and will continue rising thereafter. The first A 310 is in final assembly, will fly in the spring, and will enter service in March 1983. Orders for it now total 153 (79 + 74). Forty airlines, distributed over the five continents, have thus ordered a total of 469 A 300's and A 310's; some 30 are now using A 300's. Based on the long-term needs of these 40 companies, the number of Airbuses of the two types they should be buying probably exceeds 700, which justifies as of now the contemplated future production rates (8 to 10 planes a month) and the positive outlook for the A 320, for which the A 300 and the A 310 are now opening the way to the marketplace.

An analysis of the long-term market (that is, projecting it to the year 2000), based on an a 5.5- to 6-percent average annual traffic growth, yields the following results with respect only to the short- and medium-range planes that will then be in service:

--Category A 300 (250/300 seats): 704 planes, 360 of which only for airlines that are already clients of Airbus Industrie. This would leave 344 planes to be divided between Airbus Industrie and Boeing;

--Category A 310 (200/250 seats): 1,610 planes, 347 of which for airlines that are already clients of Airbus Industrie, leaving 1,263 planes to be divided between Airbus Industrie and Boeing;

--Category A 320 (130/180 seats): 2,341 planes, 768 of which for airlines that are already clients of Airbus Industrie;

--Category TA 9 (300/350 seats): 1,477 planes, 604 of which for airlines that are already clients of Airbus Industrie.

Assuming the 40 airlines remain loyal to the European consortium, out of a grand total of 6,132 short- and medium-range planes, 2,079 planes may be expected to be placed in service by these 40 companies. Of these 2,079 planes, as we have seen, Airbus Industrie has already placed 316 of its A 300's, 153 of its A 310's and 50 of its A 320's; thus, the European consortium should expect to deliver between now and the year 2000 a total of 1,560 planes: 44 of its A 300's (and A 300-600's), 194 of its A 310's, 604 of its TA 9's and 718 of its A 320's... .

Of course, subject to the actual needs of the purchasers, there could be more need for A 300's and A 310's and less for TA 9's, particularly if traffic does not grow as fast as projected. On the other hand, other purchasers may be expected to join the present 40 airlines! Some, however, may go to Boeing or, more simply, may not wish to be tied to a single supplier; the latter supposition would favor Airbus Industrie, since it is Boeing that has the greater number, by far, of exclusive clients.

The assumption of a total of 2000 planes to be supplied out of a grand total of 6000, or one-third of the world market, thus appears very reasonable; and the chances are very good that Airbus Industrie will actually do better... .

The 4,053 remaining planes thus represent, at best, the planes to be furnished by Lockheed, Douglas and, above all, Boeing; but here again, the figure also includes the planes already delivered and, in the case of those to be modernized, already in service--for example, the DC-9 Super 80's (110 sold to date), the B 727-200 RE (up to 800) and, very probably, the DC-10-10's and L-1011, likely also to be re-engined.

The problem for Boeing is therefore to actually place the largest number of planes out of this total of 4,053. If we assume that Douglas will finally place 200-300 of its DC-9 Super 80's and that 200-300 DC-10-10's and L-1011's are likely to be re-engined, as well as 400 Boeing B 727's, this means that at best, 3,000 (and possibly many less) planes will finally be left for Boeing to sell. Subtracting the B 767's and B 757 already sold--to date, 311 of the B 767's (173 + 138 options) and 199 of the B 757's (138 + 61)--this leaves Boeing with 2,500 planes to sell...

For a builder of the magnitude of Boeing, in a semi-monopolistic position for the past 10 years, a comparison of the figures shows that the challenge represented by Airbus Industrie is an extremely dangerous one for the said builder. The most convincing evidence of this is that after having over these many past years referred condescendingly to the A 300 as a non-negligiblecompetitor, Boeing has now taken in most cases to pretending the European competitor does not even exist: A tactic that betrays a certain fear... .

9399
CSO: 3102/34

## TRANSPORTATION

### FITERMAN INTERVIEWED ON AIRBUS INDUSTRY EXPANSION

Paris AVIATION MAGAZINE INTERNATIONAL in French 15-31 Oct 81 p 19

[Interview with Charles Fiterman, minister of transport; name of interviewer, place and date of interview not given]

[Text] [Question] In the aeronautics sector, there are expectations that the A-320 program will be launched officially toward the end of this year. Where exactly does this stand and, in your opinion, what are the problems involved in launching this plane?

[Answer] Preparations for embarking on the A-320 program are proceeding normally. As you know, I met with my British and West German counterparts in July on this matter. As you also know, the problem was brought up outside the agenda of the Franco-British summit held at the beginning of September.

The concerns of the moment are: The obtaining of new market orders, the technical specifications of the new plane, and the development of Airbus Industrie's industrial organization and of cooperation within the GIE [Economic Interest Group]. True, we are in an economic situation that presents difficulties. But we are all in agreement in recognizing--and this is not new--that there is a substantial market for this type of plane between now and the end of the century. This is why the difficulties can in no way be allowed to constitute an obstacle to the bringing out of this plane.

Now as to the date by which we should be in a position to decide formally on the launching of the program: A tentative agreement has been reached to meet again toward the end of this year. And I hope we will be in a position by then to take the necessary decisions without undue delay. In any case, France will do her utmost toward that end.

[Question] The British and French governments have announced recently that they would like to have a substantial share in this program. Across the Channel, there is even talk of Great Britain participating to the extent of 30 percent. What is France's position in this respect?

[Answer] Great Britain's initiative in stating its intent to take a substantial part in this program attests the interest it has in bringing this new plane out on the market. France is very pleased to know this. And I can tell you that the French government is prepared to back a sizeable participation in this project. Let me remind you that we we are now participating in the Airbus programs at a level of 37.5 percent.

Of course, we have not yet decided the percentage of our participation in the A-320 project, since it will depend on the different partners and the extent of their participation. But in any case, France is ready to take its full share.

[Question] In fact, as regards the partners, the FRG, which participated in the first Airbus programs, is showing signs of a certain reluctance with respect to this new program. If the FRG were not to participate in the development of the A-320, would you favor limiting the program, to the extent it can be limited, to a joint French-British effort, or broadening the joint operation to include other countries, indeed even non-European countries?

[Answer] The Germans are presently having problems of a budgetary nature. This explains their relative caution. However, the fact is that during the discussions we had with them in July they reaffirmed their intent to go ahead with detailed planning on the A-320 project; hence, their attitude toward it is positive. That being said, as far as we are concerned, we are open to any proposed broadening of the partners--with no prior reservations.

[Question] Once it is decided to go ahead with the plane, it will need an engine. Recently, you referred to the possibility of a joint French-British undertaking in this domain. Can you give us some details on this point, taking into account of the fact that the engine manufacturers that would be involved in this operation (SNECMA [National Corporation for Aircraft Engine Design and Construction] and Rolls-Royce) are already engaged in joint operations aimed at developing engines specifically to fill this gap?

[Answer] The cooperation that exists between SNECMA and General Electric for the CFM-56 is highly fruitful. And, from our governmental point of view, we hope it will continue, to include the development of the CFM-56-2000 for the A-320.

Nevertheless, we have before us a British proposal to explore the possibilities of a joint operation among Rolls-Royce, SNECMA and General Electric to develop engines of this type. I can say that we have no prior reason to refuse such an approach. True, an operation of that nature would pose a number of problems. But from the standpoint of the principle involved, the French government feels possible Franco-British cooperation in this domain could be very interesting, provided it did not upset existing cooperation or slow the development of certain programs.

[Question] Let us suppose the plane is to be built. In the event the French government were to give the green light to the development of the CFW-56-2000 the decision must be taken in time for the engine to be delivered in 1986. What is your thought on this?

[Answer] The French government--and you will see this in the 1982 draft budget--is disposed to do everyting in its power to ensure that the production schedules of the plane and the motor are brought together and that they are completed in the shortest time possible.

[Question] A developmental program for a plane and one for an engine add up to a considerable cost. Does the government consider this program a priority matter?

[Answer] It is indeed a priority inasmuch as the overall priority of the government's policy is to create jobs. And it is evident that the development of new initiatives in the field of aeronautics construction will lead to the maintenance and creation of a not inconsequential number of jobs. In the 1982 draft budget that is to be submitted to Parliament, this section is being increased by 55.4 percent.

[Question] But if one considers the figures, all of this adds up to a substantial cost. Will it also be possible to go ahead with the ATR-42 commuter plane?

[Answer] I do not think it can be said a priori that all of this is costly. For it is not a matter in the case of the Airbus programs of pouring funds down the drain. As in the case of the A-300, and then of the A-310, the A-320 must within a certain length of time lead to a return on the Airbus programs. That is its objective.

I recognize, of course, that the investment that is indispensable to the launching of such programs is an obviously large one. But I am convinced that the future of our economy depends upon developments of this order.

Insofar as concerns the ATR-42 program (a program we are planning to develop jointly with Italy, and which is clearly much smaller in scope, hence in cost), proposals are due to be submitted to us shortly by the industrialists. And if those proposals prove viable, the government will take the necessary decisions to ensure that the development of that plane, for which there appears to be a market from the international standpoint, is not delayed--even though the 1982 budget, as presently drawn up, does not take into account the development of this new plane... .

9399
CSO: 3102|32

TRANSPORTATION

## VFW PERFORMS GROUND-BREAKING WIND TUNNEL TESTS FOR AIRBUS

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 13 Oct 81 p 5

[Article: "How Flow-Favorable Are Running Engines?"]

[Text] United Aeronautical Works, Ltd, Bremen--In the VFW's [United Aeronautical Works] wind tunnel, engineers have succeeded in making flow measurements on an experimental Airbus wing with the help of a new type of experimental engine. According to VFW, the results of these measurements demonstrate precisely for the first time the performance of wide-body aircraft during takeoff and landing. The factory in Bremen has an experimental instrument which is unique in Europe and which could make a substantial contribution to improving the performance of the aircraft in the Airbus family.

Modern engine development with increasingly higher bypass ratios (ratio between the cold and hot gas flow in the engine) has resulted in engines which--relative to the dimensions of the aircraft--have become increasingly larger. Thus, by necessity the engines must be placed closer to the wing. As a result, today the aerodynamic interactions between the engine, the pylon and the wing--so-called engine interference--play a substantial role in the overall resistance balance of the aircraft and thus have a substantial influence on the economical operation and competitiveness of a modern civilian airplane. This problem has forced the wind tunnel engineers to seek realistic engine simulation in the wind tunnel.

The most modern experimental engine currently available has been used for several months in the Bremen wind tunnel for experiments on Airbus configurations. This experimental engine--the model used has a scale of 1:16 in respect to the original engine--has a real fan which has the same performance data as the collecting supercharger of the large design. Thus, the secondary jet of the engine (the cold jet surrounding the engine), which basically is responsible for the interferences with the wing and the pylon, is totally simulated.

The difference from the original engine is concealed under the jacket. There we do not find the miniaturized gas turbine of the airplane engine, but rather a tiny compressed-air turbine which is driven by cold air. This air is fed into the engine through the wing of the wind tunnel model and the pylon at a pressure of about 25 bars. The shaft horsepower of the turbine is considerable; in the engine on a 1:16 scale, whose fan is about 12 cm in diameter, the turbine generates almost 80 hp. After expansion, the propelling air flows out of the primary nozzle of the experimental engine and thus simulates the primary jet of the real engine. The speed of this experimental engine is almost 40,000 rpm.

The wind tunnel experiments with such an experimental engine are extremely complicated. The purpose of the experiments is to measure slight differences in resistance for various nacelle and pylon forms and arrangements. In order to be able to do any measuring at all of such resistance differences, which can be of considerable importance for the economical operation of an airplane, the thrust of the experimental engine must be calibrated with great precision so that errors in measurement do not mask the result being sought.

These experimental engines, called TPS's (turbine powered simulators) in the jargon, have been used to date to investigate engine interference in the cruising range in supersonic wind tunnels, according to a report from VFW. Application for the low speed range, thus for takeoff and landing conditions, was considered impossible because of the great influence of errors in measurement. According to the company's data, a special method of suspending the experimental engine in the wind tunnel, with force-free feeding of the propelling air, and specially developed computer programs for evaluating the measurements have increased measuring precision in the Bremen wind tunnel in such a way that even in the low speed range small differences in performance with various engine and pylon arrangements can be demonstrated and their causes recorded.

12124
CSO: 3102/24

TRANSPORTATION

## BAE SAVES TIME, MONEY WITH NEW PROCESSES FOR A 310

Duesseldorf VDI NACHRICHTEN in German 25 Sep 81 p 4

> [Text] When the logarithmic expansion of a material exceeds 50 percent, it is described as superplastic. Many alloys can be expanded up to 2,000 percent of their original length without contracting or breaking. During diffusion bonding, the surfaces of the pieces to be joined react to effect a fusion of the metals through recrystallization, crystalline growth and diffusion. The bonding temperature is about 0.5 to 0.7 of the melting temperature of the material.

Superplastic titanium alloys are opening up a new path to more cost-efficient hollow-shell construction. Flat blanks can be joined in a press and expanded through the controlled application of force. British Aerospace is producing four jack cans for the A 310 Airbus using this method, which will save DM 5,000 per aircraft.

Two operations can be carried out in the same installation in the "superplastic forming and diffusion bonding" process, SPFDB for short. Both superplastic forming and diffusion bonding require pressure and high temperatures. It was therefore only a matter of finding materials for which the figures determining forming and joining are the same.

The aluminum alloy "Supral" is superplastic, but only a small amount of component weight can be saved. The strength-to-weight ratio of the titanium alloy Ti6 Al 4 V is considerably higher. Moreover, the material can be superplastically formed at the temperatures and pressures required for diffusion bonding, while being stretched up to 10 times its original length. When Ti6 Al4 V or titanium A-10 is heated to 950°C under protective gas, the oxide skin is absorbed and the surface reacts by flowing under pressure, which results in a structural bond with the other part.

The jack can, with its corrugated stiffenings (single-column photograph), is diffusion-bonded and pressure-formed in the same press. The container protrudes into the fuel tank in the wing where the jacks operating the leading-edge slats withdraw when they are retracted. The heated form holds the two metal blanks securely along the edges, except for the edge at the open end, so that they can be joined. Protective gas is then introduced between the unbonded surfaces, and under its pressure the sections are inflated until they assume the contours of the form.

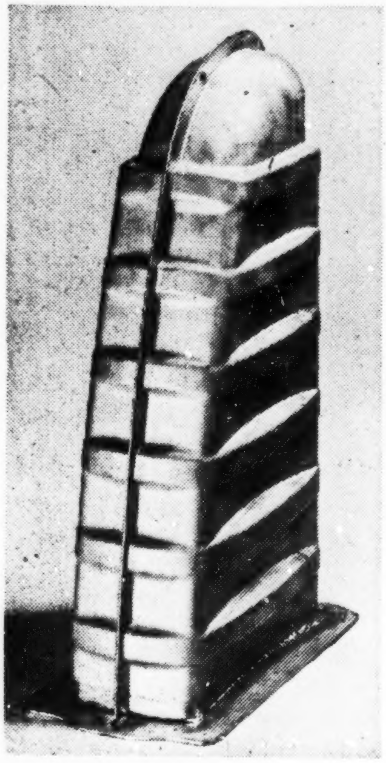
The flange at the open end is welded on in a subsequent operation. The jack can is only two-thirds as heavy as one made conventionally, but is just as dent-resistant. The two pieces of metal are molecularly bound in the diffusion-bonded join, as if they were a single piece of metal. The joint is not permeable by liquid or gas.

Using this process, containers can be bonded and formed by hollow-shell construction, including a core, in one operation. The pieces which are to be used as ribs are surface-coated where diffusion bonding is not to take place. Above and below the rib pieces two other sheets are inserted for the outer skin. When the skin has been expanded by gas pressure to conform to the mold, the rib pieces are inflated. During the operation their structure resembles a quilt. The pressure of the gas is maintained until the ribs also assume their final shape.

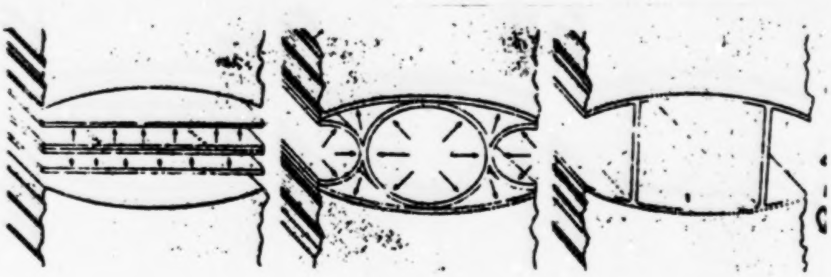
Already 6.4-mm thick titanium sheets have been superplastically formed at gas pressures up to 21 bar. This can take from several minutes up to one-half hour with aluminum alloys. The gain in time is still considerable if integral construction can be replaced by hollow-shell construction.

On the average, 45 percent fewer man hours are needed when no rivets have to be inserted and machining work is no longer required.

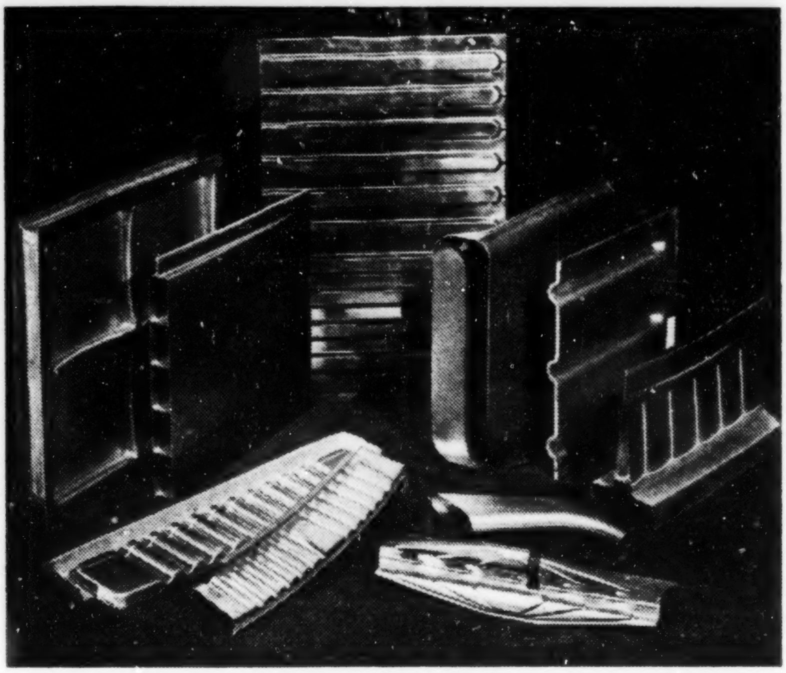
British Aerospace estimates that by using the combined diffusion-bonding and pressure-forming process, 4 percent by weight of the parts previously made from aluminum can be manufactured more cost-effectively. The new process could also be more economical for 75 percent by weight of titanium alloy parts that are not made from forged pieces and 10 percent of the steel parts.



The Airbus container, which forms an unobstructed recess in the fuel tank for jacks, was bonded and pressure-formed in one operation from a titanium alloy, with the exception of the bottom flange.



Skin with internal stiffening: Between the outer skin pieces, two other pieces are introduced into the form, which is heated to 350°C (left); after the skin, which is diffusion-bonded along the edge, has been formed to the mold, the center pieces expand under gas pressure everywhere that they are not bonded together (center); following additional application of pressure, the core forms ribs where it is bonded to the skin.



All these parts were manufactured from superplastic titanium alloy by diffusion-bonding and pressure-forming.

9581
CSO: 3102/31

## BRIEFS

MORE HIGH-SPEED TRAINS--The study of two new TGV [High-Speed Train] routes--one to the south and southwest and the other to the north--is to be accelerated following the request made by the president of the Republic that these two projects be revived. Modeled on the TGV-Paris-Lyon-South-East, the "TGV-Atlantique" has already been the object of detailed studies by the SNCF [French National Railroads]. This new route, which would put Rennes and Nantes just 2 hours away from Paris and 3 hours from Bordeaux, would represent 346 km of railway and would cost Fr 6 billion, according to current estimates. Starting at Montrouge-Chatillon at the southern edge of Paris, the new line would cross the Beauce and would then split into two branches at Vendome: one branch toward Saint-Pierre des Corps et Monts, south of Tours; the other branch toward Arnage, south of Mans ending at Laval, with a branch line going west of Arnage toward Sable by way of Angers-Nantes. The "TGV-Nord," which is at a much less advanced stage than the western route, it seems, was studied while the construction of the tunnel underneath the English Channel was being contemplated. The revival of the Franco-British tunnel project is therefore going to revive the study of the TGV-Nord project, which will provide 462 km of new railway lines, 384 km of which would be in France and the rest in Belgium. Its cost has been estimated at Fr 6 billion. The Belgians, the Dutch and the Germans have indicated their considerable interest in this project, which could provide the beginning of a new high-speed international network across Northern Europe. TGV-Atlantique and TGV-Nord could be built within 6-7 years. [Text] [Paris AFP SCIENCES in French 24 Sep 81 p 44] 9238

CSO: 3102/34

END

END OF
FICHE
DATE FILMED
8 Dec 1981